INTEGRATED ASSESSMENT OF THE TECHNICAL CONDITION OF THE HOUSING PROJECTS ON THE BASIS OF COMPUTER TECHNOLOGY

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ABSTRACT

The article discusses the need to use statistical methods of estimation and decision-making on operational reliability and durability of building structures and materials based on the accumulation of complete, continuous, reliable and uniform statistical information relating to the stages of development, implementation and maintenance of residential buildings.

INTRODUCTION

In recent years all over the world is a qualitative change of project production. This contributes to the birth of the high personal and other equipment, the introduction of new information technologies and new design tools.

The observed trend in the world information society, which is understood as the process of forming a highly informational environment, covering all aspects of life, forcing the construction industry rapidly connect to this process.

Today it is widely used automated systems of various kinds. There are industry-CAD and CAD construction projects. The latter are often developed as separate sections of the project: architecture, engineering, network engineering, technology, cost estimates, construction management, etc. The effectiveness of the CAD is largely dependent on the improvement of its information systems. At the present stage the necessity for the expansion of the system by adding information about the operation of the facility construction.

The fact that in the present conditions in the design of the various departments involved: the architectural, design, engineering, technology, estimated, organizational, etc., ie the result is obtained as a project to collect from the elements. Creation of mathematical models describing the behavior of the building, as a complex object difficult task. Not to mention the specification change its state over time.

From this it follows that the designer at the design stage and making design decisions cannot answer what the next operating costs will cause the choice of a building material, of a kind designs, a particular design solution.

Studies of various authors on the analysis of the causes of defects and destruction of structures and reduce their reliability in the design, construction and operation allow you to specify the main factors affecting the reliability of buildings and structures:

Insufficient consideration of the specific conditions of the working environment and operational factors in the design.

The absence of experimental data on actual rates of depreciation and actual physical and mechanical properties of some building materials during the operation.

Lack of an adequate system of preventive maintenance of the building is operated.

On the other hand the importance of this problem confirms the analysis of literary sources, will determine the amount of costs for the entire life cycle of the building, ie the ratio between cost and time on these three stages of construction - between design, erection and operation.

Known as computer-aided design in modern conditions lasts depending on the complexity of the object from one to several months and the cost is about 1-2% of the cost of construction, the construction of the building, depending on its complexity lasts from several months to several years, operation, etc. is maintaining the building in good condition, lasts tens or even hundreds of years, and every year it cost only 2-3% of the replacement cost of the construction part and 4-5% - for the maintenance of engineering equipment. From this it follows that roughly every 12-13 years for buildings costs equal to the cost of their construction, but when compared to the cost of designing the figure much higher.

Meanwhile, it is at the design stage laid subsequent operating costs because it is at this stage, the selection of certain construction materials, construction technologies, design solutions for the construction, which will subsequently be used for many decades.

An important issue is the question of evaluation and elimination of obsolescence structures. It is known that compensation obsolescence residential buildings, spent an average of about 10% of all capital investments.

Thus, there is a need to create within design automation systems, data-processing subsystem predict subsequent behavior structures, based on the regular collection of information operated facilities.

These issues and pays great attention worldwide. So this summer on the Internet I found information that the research center in England Building Technologies, British Construction Association, a government research centers of England, as well as numerous universities and commercial firms in the European construction program begun implementing the largest and expensive to date research project. The city is built Cardington group of buildings varying heights in life-size, with different technologies, using on different floors of buildings of various kinds of designs and materials. Constructed buildings used to study their reliability, efficiency and quality evaluation of new alternative methods of construction.

The main objective of the study - improving the reliability of construction, evaluation of existing and introduction of new designs, materials and technologies in order to minimize the total cost required for the construction and post-construction

services for buildings and facilities. Including in order to create an information base that allows for computer-aided design stage to predict the future costs of operating the building.

The need to develop computer technology integrated assessment of technical condition of housing caused by a variety of circumstances.

First, the study of the question assessing the state of the building, both physical and moral, in operation until now been neglected. Battery life of buildings and obsolescence are defined regulations rather roughly. The rules lifetime of buildings and its individual components and structures is not regulated. This is due primarily to the fact that there is no tool allows you to process and store information on integrated assessment of technical condition of the housing from the date of construction during their lifetime.

Secondly, the operation of buildings constantly have to deal with longevity basic designs of existing buildings. Excessive durability of building elements, both in new construction and repairs of buildings will be linked to the rise in prices of construction and reconstruction, and lack of durability - the appreciation of the buildings.

Third, it had to create a computer technology expertise feasibility study and project design decisions based on the data of operation of housing projects with recommendations about the appropriateness of the planned construction.

In the fourth development of the construction industry is the need to create a data bank of progressive technologies and construction techniques, materials and structures which may create based on a comprehensive assessment of technical condition of the housing during operation.

Thus, the development of computer technology integrated assessment of technical condition of housing is very important.

According to the analysis of literary sources identified the main factors affecting the reliability of the structure.

factors reduce reliability

- Climatic conditions
- Internal environment
- Aging, wear
- Lacks structural building layout
- Low quality designs
- Low quality joints
- Violation of technology repairs
- Inappropriate use of
- Delays repairs
- Low level of training of personnel
- Lack of funding

factors enhancing reliability

- Improvement of the constructive scheme
- Consolidation of the structural elements
- The use of durable materials
- Quality control repairs
- Advanced technology of repair
- Use of standard components
- Improved maintainability
- Reduced impact fracture
- Protection of structures against
- Clear scheduled repair
- Conducting prevention

In Sweden, the United Kingdom, Ireland, the United States and in other capitalist countries, as well as in Russia used similar Methods determining the total cost of construction and operation of housing, although the various terms, the most common of which are: "The general value of the building, "" final price "," marginal cost "and" cost associated with the use. "

Used three different methods to determine the total cost of the building, ie the total cost of construction and operation of dwellings: 1) the total annual cost method, 2), is the total cost accounted advance, 3) the total cost method.

The essence of the method of calculating the total annual cost is that both one-time construction costs and future costs of its repair and maintenance during the billing period are converted to annual costs.

Feature of the method of calculating the total cost accounted advance is that future (estimated) costs of repair and maintenance of residential buildings for the entire expected life of its service are converted to the calculated amount in advance to the actual completion of the year, which added to the original cost of the building. In this regard, the method in question is also often referred to by value of the moment.

In contrast, the method of calculation of the total cost is to convert all costs and expenses for the construction, maintenance and operation of a residential building for the entire expected life of his service in the estimated amount of the year expected demolition of the building (the so-called accrued expenses).

Technical evaluation of housing projects capitalist countries and Russia has its own peculiarities. They are based on extracting the maximum profit in both the construction and operation in the field of housing. Level of income received or expected - that determines the useful life of dwellings in the capitalist countries.

When the house, the construction of which although they are in satisfactory condition, become unprofitable, it demolished. Demolition is not just an old house, demolished the house without bringing sufficient profit, replacing it with a new residential building with apartments of a higher quality and more often - commercial or office building, usually bringing higher incomes. However, other houses of the same age, if they are profitable, retain their useful. Lifetime even larger costs of operation and maintenance.

For profit useful life fully extended. In Western Europe, for example in France, after the end of World War II, was built a lot of time and comfortable residential buildings made in the USA. Standard life of these buildings (10-15 years) have actually been significantly extended in view of the acute housing crisis, as well as lack of administrative buildings, which generally caused even opportunistic increase the market value, ie prices for temporary buildings compared with the original value.

Economic life of a residential building may be extended due to the adaptability of the building to the new conditions, through a combination of repairs and redevelopment and rising internal improvement of existing dwellings.

Differences in the lifetimes of individual building elements and building technical devices allow, and often justify replacing them instead of downtime due to wear make changes and layout of apartments and buildings in general, in the

appointment of the premises, not to mention the quality of finishing. Implementation of such measures to modernize and upgrade of residential buildings on a modern technical basis aimed at eliminating obsolescence dwellings, though, and is based on data on the technical condition of the main load-bearing structures, nevertheless ultimately determined by the economic results of these activities, a in many cases social (cultural, historical and architectural) value of these results.

Thus, the age of a residential building in itself is only one factor in his physical condition, but is not always the main factor or criterion in determining the economic and social value of the building. Great influence of a complex set of factors of technical, economic and social order on the wear of residential buildings, and consequently on their lifespan.

In this regard, it should be emphasized that it is wrong to talk about the service life of a residential building only as a physical concept. Anyway this is not enough. More correct to speak about the useful or economic life.

Studies have shown that an important issue in the analysis of a constructive solution is to analyze the impact of selected structural element of the building to change the subsequent operating costs. In order to study this problem was carried out pre-planned multivariate computer experiment.

As a variation interval boundaries factors were taken to calculate the change proportion of reconstruction compared to newly constructed residential building (in%) for the entire period of operation depending on the selected designs.

The obtained data were subjected to multivariate correlation - regression analysis on koipyutere using a program developed by my thesis on the well-known algorithm. As a result, we determined the coefficients of multiple regression statistics calculated correlation and regression analysis, assessed materiality factors-arguments.

The calculation was performed on various types of regression equations. Selecting a large number of types of regression equations due to the search for the best option depending on simplicity and its significance by Fisher.

Subsequently, the linear model was adopted because it adequately describes this relationship with sufficient reliability and has the smallest number of coefficients of the equation, which reduces the complexity of its use in subsequent calculations.

Y = (1218,20-2,13 * X1-4, 37 * X2-10, 80X3-10, 25 * X4) / 100

Where ***Y*** - the coefficient of variation of operating costs, compared with the original cost of the building;

Useful lives in years: ***X1*** - floors, ***X2*** - roofing, ***X3*** - finishing inside, ***X4*** - engineering equipment.

As a result, found that most influence the quality (lifetime) interior finishes, roofing, plumbing equipment and floors, a negligible impact, which can be neglected, have other design elements (Figure 1).

The next stage was to develop flowcharts and algorithm integrated assessment of technical condition of housing.

Proposed computer technology has systemic unity and compatibility, as well as dimensioning software with standard software used in CAD. Software implementation

of the task performed on the high level programming language DELPHI. The choice of this environment is associated with many features of the language when working with databases, in addition, programs written in it can both initiate and handle almost any event Windows.

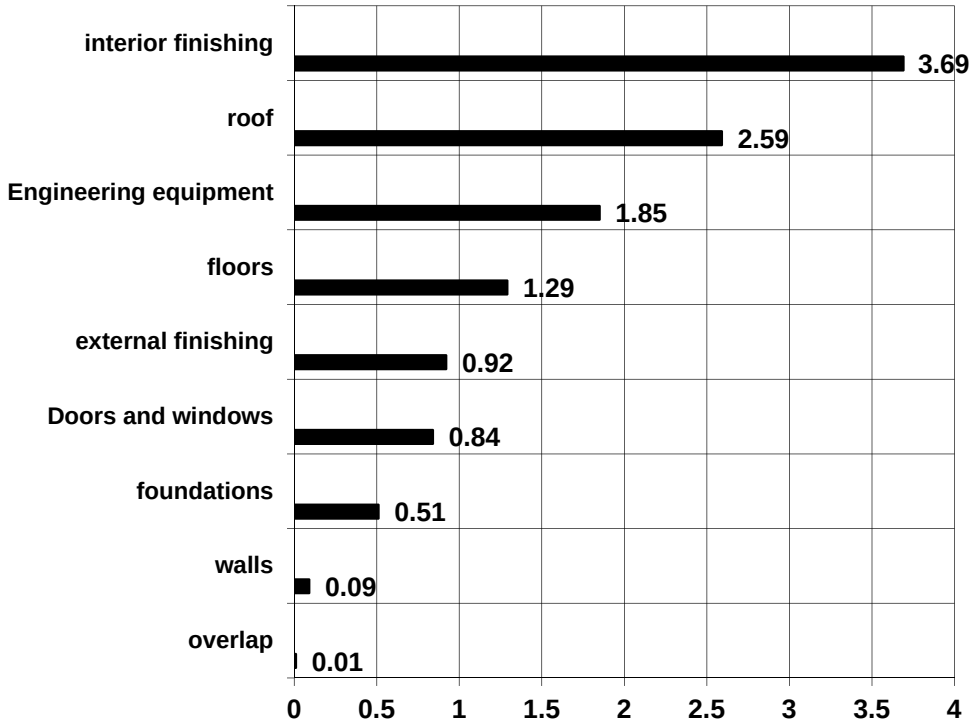

Figure 1. Degree of influence of the type of structural elements of the building to change the operating costs.

Developed algorithm created by software integrated assessment of technical condition of housing, which allows for an instrumental and visual examination of a residential building to receive the desired information.

Approbation of the proposed computer technology on data from the literature showed that the chance of a comparative analysis of different design solutions, both at the design stage in the CAD system, and in the assessment of existing buildings.

For example the proposed method allowed by the use of optimization methods for increasing the value of 1 m^2 of living space on 3% reduction in the total cost of repair of the building for the standard service life by 11% or when converted into U.S. dollars at the moment about 100 thousand dollars, with an increase in the optimal life of the building by 9%.

Scientific novelty lies in the fact that:

• as a result of multivariate computer experiment identified and are ranked factors affecting the change in operating costs of residential buildings;

• An analytical dependence in order to assess the impact of selected CAD system type structural element of the building on subsequent change of operating costs;

• for inclusion in the system design automation scientifically substantiated and developed the structure and method of construction of information technology training data for integrated assessment of technical condition of the housing;

• established and scientifically validated system for determining cost-effective service life of residential buildings subject to wear and tear.

Practical significance of the work lies in the fact that the collection of the results of the automated assessment methodology provides the technical condition of housing, allowing the development of projects undertaken to improve CAD designs.

FINDINGS

The analysis showed the need to create a tool to establish the causes that lead to an increase in operating costs and accelerate obsolescence, for both existing and planned buildings. To solve the above problems because of the need to accumulate, store and process large amounts of information is only possible by using modern computer technology.

Studies have shown that the lag in the development of physics reliability issues necessitates extensive use of statistical methods for assessment and decision-making on operational reliability and durability of building structures and materials based on the accumulation of complete, continuous, reliable and uniform statistical information relating to the stages of development, manufacture and operation of residential buildings. The solution to this problem is possible only with the use of modern computer technology.

Found that the optimum life of the building is determined by the physical deterioration, understanding this economically viable lifespan, given the impact of obsolescence, but under current conditions both of these factors are equivalent, and in the near future due to high rates of technology obsolescence issues will become more prevalent . Simultaneous consideration of the physical and moral wear reduces the optimal service life of buildings and lower maintenance costs.

As a result of pre-designed computer experiment on ranking factors (type of building parts repaired) found that the level of operating costs of the building most influence the life of the roof, plumbing equipment, floors and interior finishes. The analytical dependence, allowing to estimate the influence of the type of structural elements of the building to change the operating costs.

Found that from a technical and economic point of view it is necessary to increase the service life and uniformity of design and materials used in house construction (interior building, roof construction, engineering, equipment, etc.), resulting in lower operating costs and increase the life of residential buildings.

The analysis comparing the costs of individual components in a building under construction and the cost of restoration work similar elements in existing buildings showed that last an average of three or more times, due to the complexity of the work

and the need to disassemble or replace objects that are in good condition only because they are affected in the repair of worn adjacent elements.

Found that economically viable lifespan of residential buildings subject to wear and tear is about 80-90 years, regardless of what they actually can serve a longer period. Extending the life of the building over this age will require a cost comparable to the cost of new construction, taking into account the subsequent operation.

Asking computer technology integrated assessment of technical condition of the housing allows based on visual and instrumental inspection of the building, as well as data structures, components and systems to determine: the technical condition of the building and its structures, the optimal timing of planned preventive work, current and capital repairs, the most rational structural materials based on the results of their operation, the cost of maintenance of the building structures and materials, costs for planned preventive work, repair and overhaul; optimal solutions that minimize operating costs.

Approbation of the proposed methodology for test case has shown that through the use of optimization methods for increasing the value of 1 m^2 of living space on 5.3% can reduce the total cost of the renovation of the building for the standard life by 11-17% or equivalent to about 100 dollars - $ 150 thousand, an increase in the optimum life of the building by 9-13%.

It is recommended that the service life of structures and materials used in construction, which results in lower maintenance costs and increased service life of residential buildings.

Work accomplished allows outline directions for further research in the framework of this problem area:

• Develop methods of socio-economic and environmental assessments of design decisions residential buildings;

• development of a computer classifier defects, damages, failures and limit states of concrete structures and systems of technical devices.

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